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**EPIDEMIOLOGY OF PODIATRIC INJURIES IN  
U.S. MARINE RECRUITS UNDERGOING BASIC TRAINING**

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# Epidemiology of Podiatric Injuries in US Marine Recruits Undergoing Basic Training\*

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The authors determined the incidence of podiatric injuries that occurred during 233,946 recruit days at risk among US Marine Corps recruits undergoing basic training at the Marine Corps Recruit Depot, San Diego, CA, between February 5 and April 25, 1990. Training-related initial injuries to the foot occurred at a rate of 3.0 new injuries per 1,000 recruit days. The highest specific rates of injury occurred with stress fractures to the foot (0.56 per 1,000 recruit days), ankle sprains (0.53 per 1,000 recruit days), and Achilles tendinitis (0.39 per 1,000 recruit days).

Most injuries incurred by recruits occur in the foot and ankle.<sup>1</sup> Such injuries result in lost training time, disruption of training schedules, increased health care expenditures and provider workload, permanent disability, and attrition of recruits unable to complete training.<sup>2-4</sup> Previous investigations have reported the proportion of injuries by type, without incidence rates, as in these studies the size of the population at risk was not known.<sup>5,6</sup> As a result, epidemiological information on the incidence rates of injuries to the foot is scarce, and investigation into the causes of these injuries has been limited.<sup>7</sup>

The objective of this study was to describe the incidence of soft tissue or musculoskeletal injuries of the foot among US Marine recruits under-

going basic training at the Marine Corps Recruit Depot, San Diego, CA, between February 5 and April 25, 1990.

## Methods

**Study Group.** The population at risk included all US Marine Corps recruits undergoing basic training at the Marine Corps Recruit Depot. Podiatric injuries were identified from recruits presenting to the Podiatry Clinic of the dispensary during the same period. The study population included all recruits presenting to the clinic with podiatric injuries during the same time interval.

**Data Collection.** The Naval Health Research Center developed and implemented a computer-based data collection system to record all patient encounters during the study period at the dispensary. Two personal computers located at the dispensary were linked via modem to a central VAX computer where the real-time data entry was monitored closely by research personnel to ensure completeness.

A patient was initially logged into the system by name, with date of birth, branch of service, encounter date, and visit number recorded. After being seen by a podiatrist, diagnosis by *International Classification of Diseases—9* (ICD-9) classification, the time of check-out, dis-

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position, and recommendations for further consultations advised were entered into the system. Daily logs were printed at the clinic and were used to verify data entry.

Population counts used in the calculation of incidence rates were obtained weekly from the personnel department. Only recruits who were physically located at the base and would present to the clinic if injured were included in the population at risk.

**Diagnosis and Definition of Injury.** Recruits presenting to the dispensary were screened by a corpsman for referral to the Podiatry Clinic, based upon initial complaint and tentative diagnosis. A podiatrist made the final diagnosis and prescribed therapy. A podiatric injury was defined as any disability or complaint occurring during basic training period that 1) required a visit to the podiatrist, 2) involved musculoskeletal or soft tissues, 3) resulted from basic training, and 4) was assigned a podiatry-related ICD-9 diagnostic code. Specific criteria for each injury are described in the *International Classification of Diseases*.<sup>8</sup>

## Analysis of Data

Descriptive features of the population presenting to the podiatry clinic were summarized. Multiple diagnoses assigned during the same encounter for the same individual were considered as discrete injuries. All nonpodiatric injury diagnoses were excluded or reclassified in order to exclude diagnoses made secondary to inappropriate referral to the Podiatry Clinic. Incidence rates were expressed as the number of newly occurring podiatric injuries per 1,000 recruit days at risk.

## Results

During the study period, 233,946 recruit days at risk were accumulated. The recruit population consisted of previously screened, healthy, predominantly Caucasian 17- to 28-year-old males (mean age: 19.6). Results did not differ significantly when stratified by age, so results were reported for the entire group.

The Podiatry Clinic diagnosed 705 new podiatric injuries, resulting in an incidence of 3.0 podiatric injuries per 1,000 recruit days (Table 1). The most common podiatric injury was stress fracture of the foot (0.56 per 1,000 recruit days), followed by ankle sprain (0.53 per 1,000 recruit days) and Achilles tendinitis (0.39 per 1,000 recruit days). Stress fractures accounted for 18.6% of all podiatric injuries (Fig. 1).

**Table 1. Incidence of Podiatric Injuries Among US Marine Corps Recruits.**

Injury	ICD-9 Code	Frequency	Incidence*
Stress fracture			
Foot	733.10	84	0.36
Metatarsal	825.25	47	0.20
Ankle sprain	845.00	125	0.53
Achilles tendinitis	726.71	91	0.39
Blister			
Noninfected	917.20	69	0.29
Infected	917.30	11	0.05
Ingrown toenail	703.00	68	0.29
Lower leg strain	844.90	61	0.26
Tenosynovitis	727.06	39	0.17
Plantar fasciitis	728.71	33	0.14
Contusion (excluding toe)	924.20	26	0.11
Tinea pedis	110.40	26	0.11
Cellulitis (excluding toe)	682.70	25	0.11
Total		705	3.0

\*Incidence expressed as cases per 1,000 recruit days at risk. A total of 233,946 recruit days were accumulated over the study period.

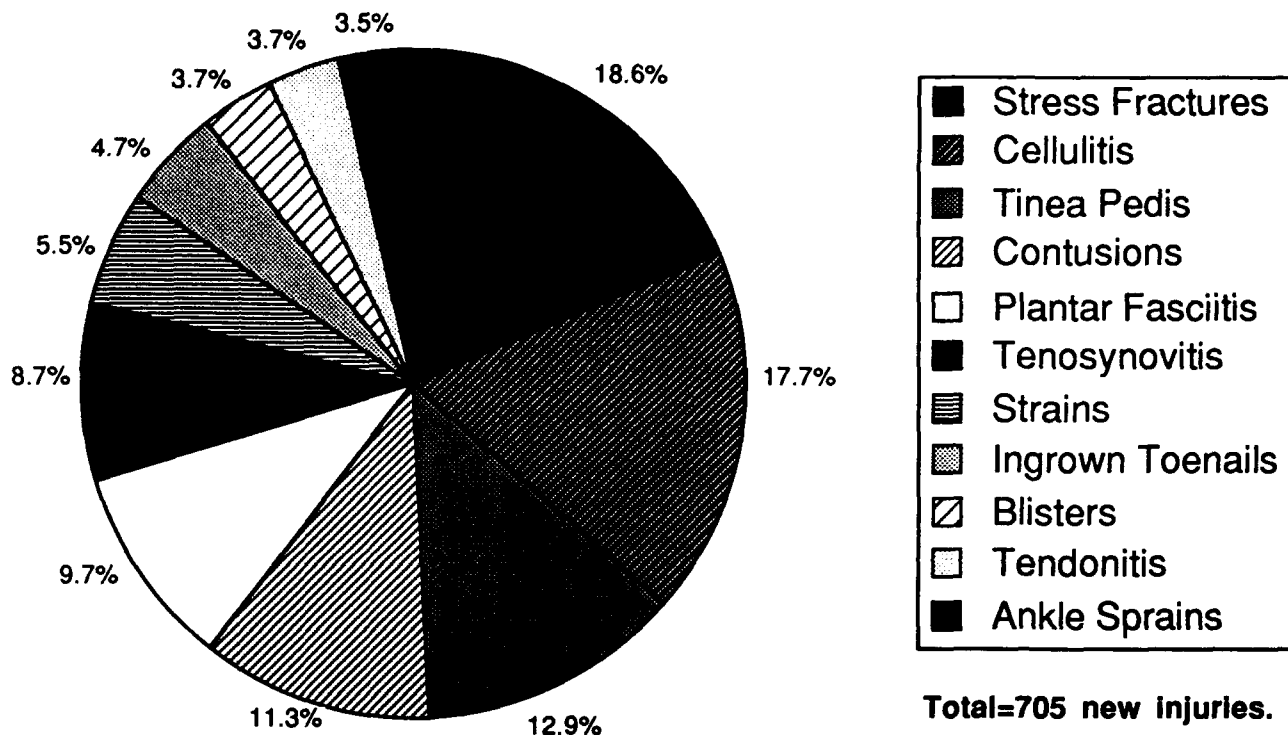
## Discussion

Podiatric injuries account for substantial morbidity among US Marine recruits in basic training. In this study, accumulating 233,946 recruit days at risk, 705 new podiatric injuries were diagnosed from February 5 to April 25, 1990, resulting in an incidence rate of 3.0 new podiatric injuries per 1,000 recruit days at risk. This translates into 9 podiatric injuries per 100 Marine recruits per month of training.

The authors hypothesize that this high podiatric injury rate is related to the special conditions recruits are exposed to during training: abrupt increases in running mileage, running on soft sand, running in boots, and short recovery periods. In other studies, a history of previous injury and body mass index have been associated with running injuries; these factors may have contributed to the high incidence of podiatric injury in this group as well.<sup>9</sup>

Stress fracture, the most common injury occurring in this group, has been associated in the past with increased physical conditioning.<sup>10</sup> Although much research has been done on stress fracture, few studies have calculated incidence rates, and fewer still have explored the etiology of stress fracture in a methodologically sound way.<sup>11</sup>

Definitive podiatric injury incidence rates are necessary as a means to both quantify morbidity in a defined population and provide a baseline for the evaluation of future intervention studies. Improved



**Figure 1.** Podiatric injuries by type among US Marine Corps recruits undergoing basic training at Marine Corps Recruit Depot, San Diego, February through April 1990.

understanding of the risk factors for the more common injuries is needed to reduce attrition among recruits in basic training. Future studies should use standardized case definitions and measure suspected risk factors using state-of-the-art biometric equipment in order to better understand the etiology of these conditions.

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## References

1. JONES BH: Overuse injuries of the lower extremity associated with marching, jogging and running: a review. *Milit Med* 148: 783, 1983.
2. STACY RJ, HUNGERFORD RL: A method to reduce work-related injuries during basic training in the New Zealand Army. *Milit Med* 149: 318, 1984.
3. JEFFERSON TO: An investigation of medical discharges from the British Army 1979-1986. *J R Army Med Corps* 135: 115, 1989.
4. GORDON NF, HUGO EP, CILLIERS JF: The South African Defence Force physical training programme. Part III. Exertion-related injuries sustained at an SADF Basic Training Centre. *S Afr Med J* 69: 491, 1986.
5. KOWAL DM: Nature and causes of injuries in women resulting from an endurance training program. *Am J Sports Med* 8: 265, 1980.
6. O'TOOLE ML, HILLER WDB, SMITH RA, ET AL: Overuse injuries in ultraendurance triathletes. *Am J Sports Med* 17: 514, 1989.
7. TOMLINSON JP, LEDNAR WM: Risk of injury in soldiers. *Milit Med* 152: 60, 1987.
8. *International Classification of Diseases: Clinical Modification*, 9th Rev Ed, DHHS publication Ser. Nos. 80-126, US Government Printing Office, Washington, DC, 1980.
9. MARTI B, VADER UP: On the epidemiology of running injuries, the 1984 Bern Grand Prix Study. *Am J Sports Med* 16: 285, 1988.
10. GILBERT RS, JOHNSON HA: Stress fractures in military recruits: a review of twelve years experience. *Milit Med* 131: 716, 1966.
11. JONES BH, HARRIS JM: Exercise-induced stress fractures and stress reactions of bone: epidemiology, etiology, and classifications. *Exerc Sport Sci Rev* 17: 381, 1989.

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